Job Safety Analysis (JSA)

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Purpose

This procedure establishes a standard method for developing, using and maintaining Job Safety Analyses (JSA) forms that will meet the requirements of OHSAS 18001 Clause 4.3.1.

A job is a sequence of separate steps or activities that together accomplish a work goal. Some jobs can be defined broadly, for example: "making concrete shielding block," "building a beam-enclosure," or "decommissioning a beam-line." Such broad definitions are not very useful for hazard identification, however. It is too easy to overlook an included task that may present a hazard. At the other extreme, a narrow definition-such as "tighten a screw" or "push the button" is also not suitable, since one would be faced with analyzing thousands or millions of minute tasks. The right answer lies in a definition that is broad enough to result in a relatively small number of subtasks, each of which can easily be analyzed for associated hazards. Jobs such as operating a drill press, erecting a shield wall, or off-loading trailers illustrate this level of analysis. Drill press operation, for example, can be divided into a few easily identified steps, such as: prepare machine for the intended specific use; lift parts from incoming parts bin; place parts in jig and drill hole; drill holes into parts correctly; remove drilled parts from jig and drill hole; load drilled parts into outgoing parts bin; and move outgoing parts bin to loading dock.

It is easy to visualize and analyze the hazards that may arise from these few steps, and record them in one category: hazards associated with the job, Drill Press Operation. Given this approach to defining a "job," it is likely that you can obtain a list of all (or at least most) jobs being performed by your Department's staff and onsite contractors. You can start your job list by examining Human Resources job descriptions, existing R2A2s, and Job Training Assessments.

Scope

OHSAS Clause 4.3.1 requires your hazard identification process to cover non-routine as well as routine activities, so make sure you first develop a complete listing of all jobs regularly underway at your facility. Then remember to include abnormal, unusual, and non-routine

operations such as major repair events, weekend operations, night shifts, contractor activities, operations conducted at remote locations, maintenance operations that are carried out infrequently but may have a high risk, and situations that involve response to emergencies.

Procedure

Select the Job to Be Analyzed

Based on the Scope, your Department or Division has developed a list of jobs whose hazards you need to assess. Now you need to decide both the method by which each job will be studied, and the priority for such assessment. Setting these priorities is crucial. In practice, the number of jobs in any organization is so large that performing a JSA on all of the listed items in complete detail is likely to be impossible, given realistic allocation of resources. ***Nearly every organization moves through this process in phases, over time. Thus, it is important to concentrate your initial efforts on those items that clearly present more significant risks and fill in other areas over time.*** In order to determine if you have sufficiently completed your job hazard analysis, your OHSAS certification review auditor will need to understand your strategy and approach, and review your rationale in developing the strategy and setting priorities.

Start by making a "rough draft" estimate of hazards and risks. Look for hazards that are obvious and risks that are clearly serious. Plan to analyze those jobs first. The risk tolerance criteria will assist you in this process[1], as will the historical information you have assembled. Information such as the known or estimated accident and injury frequency associated with a job, the number of persons affected by the job, such as, employees or contractors doing the work or other interested parties who may be affected, how often the task is performed, and the actual severity of injuries experienced from the hazard will help you set your priorities.

Draw on the personal experience of your hazard identification risk assessment team, which is an invaluable resource for many Departments and Divisions. Key operational personnel may be aware of hazards that are not apparent from historical records or to someone not familiar with the details of the operation or activity. Their insights will help you set priorities, as well as identify additional hazards. Newly created jobs that have no history should be examined carefully to establish a preliminary priority.

An example of such a "hazard analysis strategy" is shown in Table 1. In this case, the site has chosen to analyze 4 jobs or activities. The site has developed its priorities based on previous experience, information on known work hazards in each area, and the number of employees who are exposed to the hazard.

[1] See Appendix 1.

Table 1 Hazard Analysis Strategy

Job	Description	Priority	Reason
Cryogenic Maintenance Activities	Maintenance activities throughout compressor buildings	Moderate	Several splashes on workers with lubricating fluid (UNCON LB170X) have occurred in the past
Office Ergonomics	Working with computers and telephones	Moderate	A number of repetitive strain injuries have been reported to the BNL Clinic in the past
Cable Pulls	Manually pulling heavy copper cable through cable tray in the accelerator and experimental areas	High	Walking and working surface problems have been reported in the past; serious back and fall injuries have occurred
Disassembly of Beam Line Components	Rigging massive structures and segregating shielding and beam line components for re-use or waste	High	Previous numerous first aids in this area

Performing the JSA

To perform a JSA, divide the job into a reasonable number of tasks, then examine each task for associated hazards. This close analysis of numerous tasks and their associated hazards simplifies and organizes the hazard identification process. It ensures that significant hazards are not missed and provides an organizational framework for recording the hazards found, the frequency and probability estimates needed for assessment of risk, and information about controls. In this approach in particular, having a team of people is essential. In most organizations, limitations of budget, time, and expertise make it impossible to analyze every job listed. Only the more complex or hazardous tasks require such detailed analysis.

BNL recommends that Departments and Divisions use the data entry form in Figure 1 to record the information gathered during the JSA process. It contains an area to record risk classifications, in addition to the hazard identification information.

The JSA process consists of six steps:

- break down the job into successive steps or tasks
- identify the hazards associated with each step
- estimate the potential consequences of an accident associated with each hazard
- identify controls in place for each hazard

- estimate the probability of an accident occurring for each hazard (given existing controls)
- identify possible additional controls needed for these hazards

In the text below, we walk you through these steps and examine each one in more detail. To further illustrate the process, we have included a practical example in Figure 2. We present the steps in a sequence that we have found useful, in practice these steps are often conducted simultaneously.

The first task is to identify the various steps involved in the job. The written job description is certainly a good place to start, but you should also observe the job being performed and talk to the staff involved. Close observation of how each step is actually performed, as opposed to how the rulebook says it is to be done, and consultation with employees and supervisors, will ensure that your descriptions of each step are detailed and accurate.

Once you have identified the steps involved in a job, you can move on to hazard identification. For each step, identify the potential hazards. For this example in Figure 2, the possibility of injury might arise from any one of the following:

- struck by or against
- caught in, by, or between
- slip, trip, or fall
- strain from pushing, pulling, lifting, or bending
- awkward position or posture
- contact with hazardous energy sources (underground electrical lines)
- contact with sharp edges
- contact with radioactive materials
- emergency exit and egress considerations due to work performed in an excavated pit

The next step is to consider the potential consequences of an accident or illness (Consequence Level) that may happen as a result of each identified hazard, and estimate the severity of those consequences. For all the steps in the example job in Figure 2, the Consequence Level is estimated to be Medium to Low. The distinctions between Consequence Levels are as follows:

- Extremely Low: The job will not or has not in the past resulted in a significant injury or occupation illness.
- Low: Low-consequence events are events that may cause minor injury or minor occupational illness or minor impact on the environment.
- Medium: Medium-consequence events may cause deaths, severe injuries or severe occupational illness to personnel.
- High: High-consequence events may cause deaths or loss of facility/operation.

The Medium rating for Consequence Level in Steps 1 and 3 in Figure 2 was based on potential for injuries in a cave-in of an excavated pit. However, the site has no record of injuries from cave-ins. The Medium rating for Consequence Level in Step 5 was based on actual experience. That is, tank removal in the last 10 years resulted in several injuries requiring first aid, and one

recordable injury due to a slip and fall. The slip and fall injury while performing Step 5 resulted from a rutted and slippery walking surface, which caused a broken ankle.

In the example in Figure 2, the controls already in place are listed for each hazard. Note that the descriptions of controls are fairly detailed, within the space limitations of the form. This level of detail within a JSA is useful when planning for additional controls in the future.

The overall estimate of risk for the job in the example in Figure 2 must not only take into account the type of injury or illness but also how often it might occur. The next step is to estimate the Likelihood of Occurrence. JSA probabilities of injury (Likelihood of Occurrence) are typically estimated carefully through a two-step process. Since the accuracy of this estimation process is extremely important in a JSA, it is worth discussing the process in more detail.

The first step relates only to the probability of the identified accident or illness occurring ***in any one instance of the activity under consideration.*** For example, in terms of the tank removal job in Figure 2, how likely is it that an individual worker will suffer a broken ankle while performing Step 5? Answering this question must involve direct observation of the job ***while it is being performed,*** including how control measures are used, as well as a review of past experience and historical information.

One's observations may indicate that the workers performing the job have been trained and actually carry out the job by carefully taking the proper positions and assuring adequate footing to perform the job safely. Consequently, we might conclude that in this one instance of performing the task a typical worker is not very likely to suffer a slip and fall. Remember, however, that you must include the ***reliability*** of control measures in your estimate. Depending on a worker to be properly trained and to actually follow the proper steps each time is not the most reliable form of control. Protective equipment such as a work-boot with a rugged sole is also not a very reliable form of control; workers must actually wear the boots and the boots must function correctly in all types of weather. In this case, ground roughness and ice and snow affected the reliability of the work-boots.

These considerations must be included in your estimate of the probability of an accident, injury, or illness occurring. In this circumstance, we have historical information that Step 5 has resulted in injuries in the near past. This makes the probability that injuries might occur much higher. Thus, the Likelihood of Occurrence for personnel injury in Step 5 was determined to be High. Talking to employees in the area may also give you more of an indication of what behavior is typical.

In the second step for determining the Likelihood of Occurrence, one must also consider the number of people carrying out the task and how often each one performs it. To return to the example in Figure 2, if one crew only performs the job once in a 10 year period, then it is possible that the facility won't experience an injury for many years. However, if the facility employs two or three four-man crews to remove all the old tanks at once, and they work continuously throughout the year, then it becomes very likely that more injuries will occur in the future.

It is important to recognize that injury rates for any specific job may change due to environmental, physical and social factors. These factors are called Job Stressors. A Table of Typical Job Stressors is shown on Appendix 2. For example, since the tank removal job is outdoors, environmental stressors can increase the potential for slips and falls in Steps 1, 3 and 5 in Figure 2. Stressors should be considered significant potential contributors to accident or illness rates. You should increased the Likelihood of Occurrence one level when several job stressors are presenting a job or seek to eliminate or control them.

The final step of the JSA process involves assessing the overall risk and identifying possible additional controls needed to further reduce the risk of the job.

Based on the estimated Likelihoods of Occurrence and the Consequence Levels, it is possible to assess the overall risk of injury for the tank removal job in Figure 2. Using the Risk Matrix Table in Appendix 1, all risks are seen as acceptable except for Step 5 which is seen as unacceptable. Thus, the overall risk for the job must be deemed unacceptable. Action is required to reduce the overall risk prior to performing a tank removal job in the future. As indicated in Figure 2, the action is to set up an internal review group to determine if alternate methods can be used, if walking and working surfaces need to be better prepared or if additional training is needed before this task is performed in the future. Additionally, the internal review group may wish to examine typical job stressors to see if they can be removed from the job, such as only performing tank removal in good weather.

During the JSA process, it is not always possible to come up with the ideal controls for future consideration. However, by recording initial impressions of possible controls, you facilitate subsequent decision making.

If your risk assessment process points to a specific job as unacceptable risk that requires further action, you must add control measures that make the most sense, taking into account cost, effectiveness, efficiency and safety benefits. It is also important to note that a JSA has certain "outputs" in terms of identified procedures, follow-up investigations, improved PPE, new controls, monitoring, and training. These outputs must be considered and implemented at the appropriate steps in your OSH management system implementation.

JSA Results

When you finish this process for all jobs in your facility, you will have lists of jobs that identify the associated hazards as well as control measures in use; and priority actions for jobs according to the risks presented by their hazards. This information represents the "results of these assessments and the effects of these controls," in the language of the clause, and is the documentation required by OHSAS 18001 Clause 4.3.1. It will be used to create action plans that form the implementation requirements of the standard.

Because Clause 4.3.1's only reference to documentation is linked to the phrase "the results of these assessments and the effects of these controls," one could argue that, technically, the only required documentation is a list of jobs prioritized by risk. However, in practice, the JSA documentation, together with a facility or area safety analysis such as a Safety Assessment

Document for an accelerator and Workplace Hazards Analysis and Risk Assessments provides the data from which all of the risk classifications are done, and contains the data regarding existing and potential controls for those risks. Therefore, you should plan to keep your JSA estimation of probabilities and degrees of severity and the final classification of risk, as the documentation required by the clause.

This will not only meet the requirements of the clause, but provide a basis for future risk assessments, ensuring consistency for the process. JSA documents should be reviewed every year. A data bank of JSAs for all jobs should be completed over time. Remember, it is important to concentrate your initial efforts on those items that clearly present more significant risks and fill in other areas over time.

Note that Clause 4.3.1 requires that the hazard identification and risk assessment process must be used to help determine:

- facility requirements
- training needs
- development of controls

Thus, the hazard identification and risk assessment process must include some means of monitoring required actions to ensure that actions are implemented on time and are effective; and your organization must consider the results of the process and effects of controls when establishing your annual OSH objectives.

Note that Clause 4.3.1 does not require that you actually develop control measures and objectives; it only requires that you ensure the results of your hazard identification and risk assessment process ***form the basis for decisions*** about objectives and control measures.

These requirements of Clause 4.3.1 overlap with the requirements of Clauses 4.3.3 (Objectives) and 4.3.4 (OHM Management Programs). Clause 4.3.3 requires that you develop OH&S objectives and consider "OH&S hazards and risks" when setting and reviewing these objectives. Clause 4.3.4 requires that you establish a management program to achieve the established objectives. The documentation of this program is to include "designated responsibility and authority . . . and ... the means and timescale by which objectives are to be achieved." These requirements of Clause 4.3.4 amount to an "action plan," that sets forth the means to be employed, the persons assigned, and the time frame within which the objectives are to be achieved. At C-AD, OSH Management Plans are used for this purpose. In practice, therefore, by implementing Clauses 4.3.3 and 4.3.4 you will ensure compliance with the above requirements of Clause 4.3.1.

Clause 4.3.1's requirement for a methodology for monitoring implementation of control measures can be met by instituting a follow-up procedure to check on fulfillment of the action plan developed in accordance with Clause 4.3.4. A periodic hazard analysis and JSA re-evaluation program, giving priority to those jobs, activities, and facilities identified as high priority in your initial risk assessment process, will meet the 4.3.1 requirement.

Core Elements Needed for Success

The requirements of Clause 4.3.1 amount simply to establishing a documented statement of the current status of occupational health and safety at your facility. This forms the basis for actions to improve that status. The list of risks you compile will probably be quite extensive, but not complex. Good record keeping is essential to a successful effort, so make sure you take the time to set up a filing system or computer data base that makes the collected job lists, JSA forms, Safety Assessment Documents and Workplace Hazards Analysis and Risk Assessments easy to retrieve and categorize.

Figure 1: Job Safety Analysis Form

JSA Number:	Date:	[ ] New	[ ] Revised
Job Title:	Task: Number of Persons Doing Job:		
Frequency of job	[ ] Continuous [ ] Daily [ ] Weekly [ ] Monthly [ ] Yearly [ ] Seasonal [ ] Several years or more		
Affected Parties:	[ ] Staff [ ] Contractor [ ] Users [ ] Guests		

Steps in Task	**Hazard**	**Consequence Level**	**Controls in Place**	**Likelihood of Occurrence**
1)				
2)				
3)				
4)				
5)				
6)				
7)				

Overall Risk	[ ] Extremely Low Risk – Desirable [ ] Low Risk – Acceptable [ ] Medium Risk- Unacceptable [ ] High Risk- Unacceptable
Action:	
JSA Performed by:	

Figure 2: Example Job Safety Analysis

JSA Number: 15	Date: 2-7-04	[x] New	[ ] Revised
Job Title: Underground Tank Removal Involving Radioactivity	Task: Remove radiologically contaminated tanks. Survey and sample soil under each tank, remove surface soil that may be contaminated. Number of Persons Doing Job: 4		
Approximate frequency of job:	[ ] Continuous [ ] Daily [ ] Weekly [ ] Monthly [ ] Yearly [ ] Seasonal [x] Greater Than Yearly		
Affected Parties:	[x] Employees [ ] Contractors [ ] Users [ ] Guests [ ] General public		

Steps in Task	**Hazard**	**Consequence Level**	**Controls in Place**	**Likelihood of Occurrence**
1) Hand excavate to expose top of tanks and overflow piping	Cave-in potential	Medium	Slope side 1.5/1 Digging Permit Work Permit	Unlikely
2) Cut and remove overflow piping	Radiological contamination of personnel	Low	Radiological survey RWP	Unlikely
3) Excavate tanks to allow for tank removal	Cave-in potential	Medium	Slope side 1.5/1 and competent person to be present onsite during activity	Unlikely
4) Drag tanks out from hole	Spread radioactivity to environment	Low	Place plastic sheeting in area	Unlikely
5) Drag tanks out from hole	Personnel injury – caught, struck by, strain, slip, fall	Medium	Use qualified riggers Use hardhats, gloves, safety shoes	Medium
6) Lift tanks and place in containers	Personnel injury – struck by	Low	Use qualified riggers with approved slings Use hardhats, gloves, safety shoes	Unlikely

Overall Risk	[ ] Extremely Low Risk – Desirable [ ] Low Risk – Acceptable [x] Medium Risk- Unacceptable [ ] High Risk- Unacceptable
Action: Because this job is infrequent, riggers are not familiar with hazards associated with dragging a tank out of the ground. Minor injuries and a reportable injury due to a slip and fall were experienced in the past during Step 5. Set up group to determine if alternate methods can be used, if walking surfaces need to be better prepared if job stressors can be reduced or if additional training is needed before this task is performed in the future.	
JSA Performed by: John Doe	

Appendix 1 The Risk Matrix

↑ *Consequence Level*

High (Note 1)	Low Risk – Acceptable	Medium Risk- Unacceptable	High Risk- Unacceptable	High Risk- Unacceptable
Medium	Extremely Low Risk - Desirable	Low Risk – Acceptable	Medium Risk- Unacceptable	High Risk- Unacceptable
Low	Extremely Low Risk - Desirable	Extremely Low Risk - Desirable	Low Risk – Acceptable	Medium Risk- Unacceptable
Extremely Low	Extremely Low Risk - Desirable	Extremely Low Risk - Desirable	Extremely Low - Desirable	Low Risk – Acceptable
	Extremely Unlikely (Less than once in 10,000 y)	**Unlikely (Between once in 10,000 y and once in 100 y)**	**(Note 2) Medium (Between once in 100 y and once in 10 y)**	**(Note 2) High (Greater than once in 10 y)**

Likelihood of Occurrence →

Note 1: Definition of Consequence Levels -

- Extremely Low: Will not result in a significant injury or occupation illness or provide a significant impact on the environment.
- Low: Minor onsite with negligible or no offsite impact. Low risk events are events that may cause minor injury or minor occupational illness or minor impact on the environment.
- Medium: Medium-consequence events are events that may cause considerable impact onsite or minor impact offsite. Medium-consequence events may cause deaths, severe injuries or severe occupational illness to personnel or major damage to a facility or minor impact on the environment. Medium-consequence events are events from which one is capable of returning to operation.
- High: High-consequence events may cause serious impact onsite or offsite. High-consequence events may cause deaths or loss of facility/operation. High-consequence events may cause significant impact on the environment.

Note 2: 10CFR835 may require limits that are more stringent for anticipated events.

Appendix 2 Typical Stressors in the Work Place

Environmental Stressors	
Air Temperature	Dust
Humidity	Emergency Lighting
Lighting	Odor
Moisture	Oxygen Deficiency
Over Pressure / Negative Pressure	Temperature / Humidity Variation
Ventilation / Air Speed	Working Alone
Physical Stressors	
Lack of Breaks	Length of Work Day
Time Pressure	Monotony
Qualifications of Co-Workers	
Social Stressors and Issues	
Availability of Eyewashes and Showers	Availability of Changing Rooms
Responsibility for First Aid	Availability of Drinking Water
Availability of Responsible Leader	Availability of Washing Facilities
Availability of Separate Eating Facilities	Protection of Non-Smokers
Availability of Toilets	Working Atmosphere